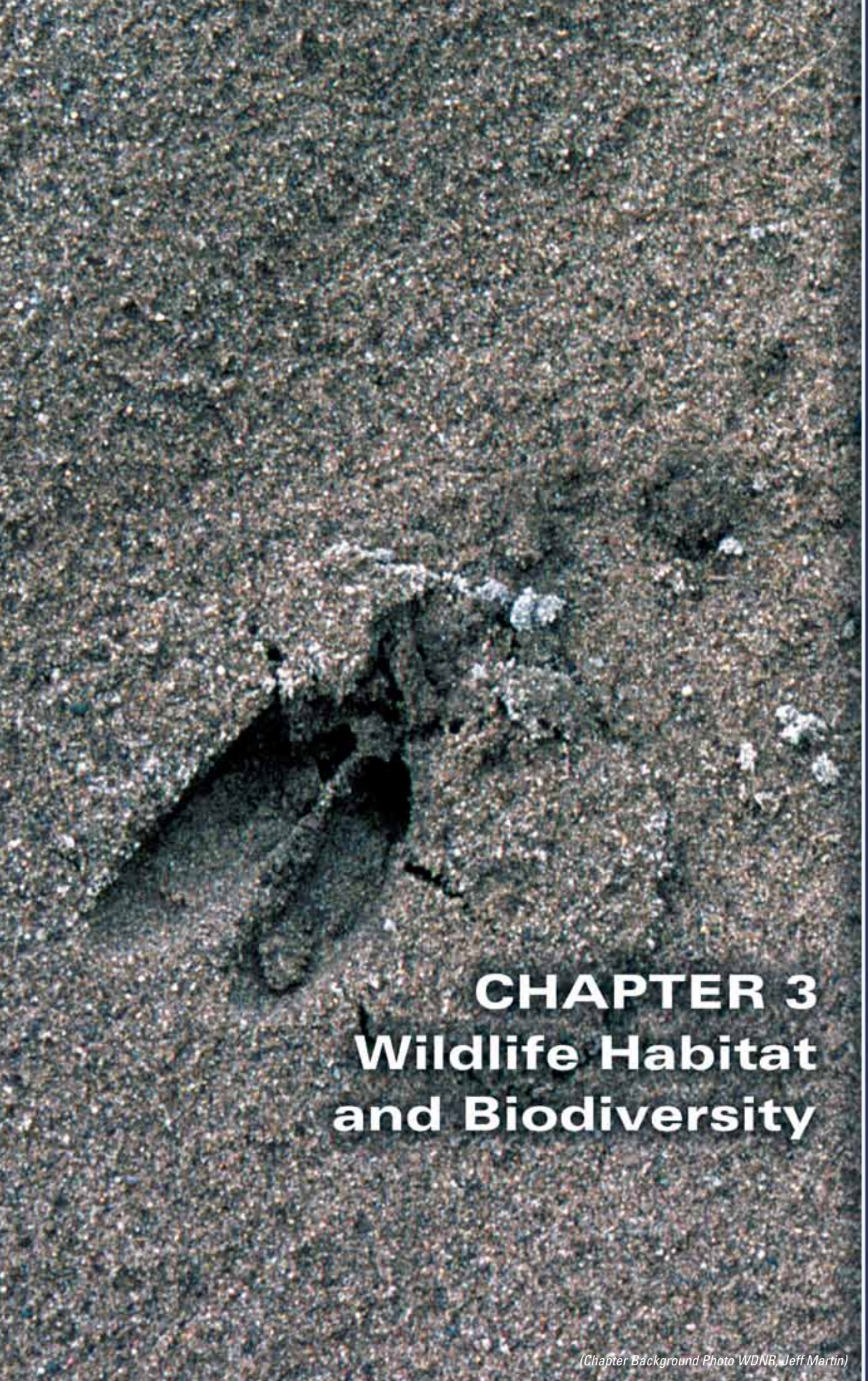

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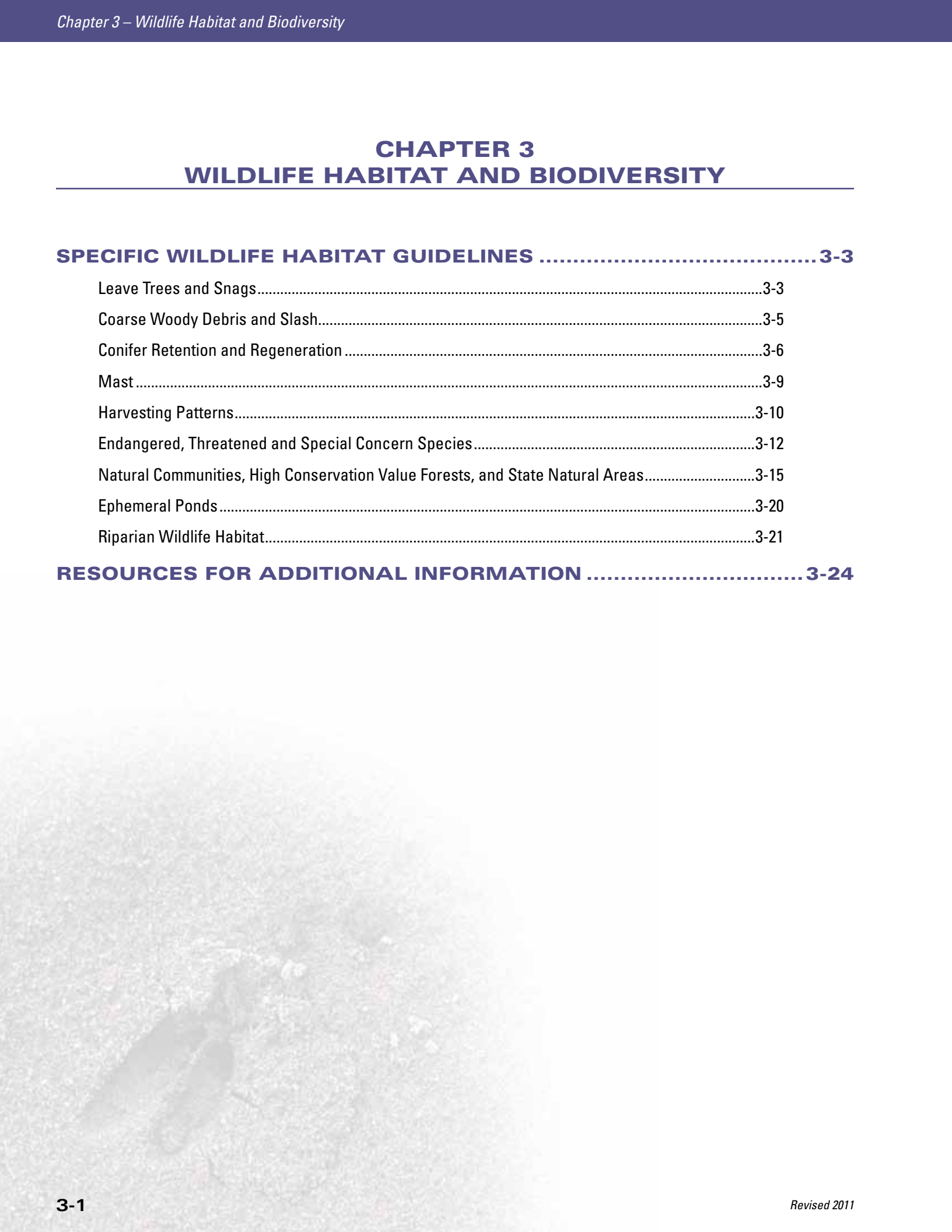
CHAPTER 3
Wildlife Habitat and Biodiversity

(Chapter Background Photo WDNR, Jeff Martin)

CHAPTER 3
WILDLIFE HABITAT AND BIODIVERSITY



Wisconsin supports a diverse natural heritage with almost 700 species of vertebrates, well over 2,000 native plant taxa, tens of thousands of invertebrates, more than 730 Lichens, and numerous non-vascular plant species. Although not all of these organisms use forested habitats, Wisconsin forests provide important habitat for many of them.

Wisconsin is at the junction of two of North America's ecological provinces and provides a number of different forest types, habitats, and niches for species to occupy. Each forest type occurs along a gradient of moisture, temperature, soil type, and climate, creating the different habitats and niches for species. Each species associated with a forested habitat or niche contributes to ecosystem functioning and, in turn, larger ecosystem processes. For example, studies have shown that insect-eating birds reduce overall levels of foliage loss from insect populations. As a result, bird populations can affect larger ecosystem processes such as carbon storage or primary productivity. Therefore, loss of organisms or groups of organisms from an ecosystem can have much larger consequences on forest health and larger ecological processes. The challenge is to conserve all the working parts within a particular ecosystem in order to maintain ecosystem resilience when disturbances occur. Simplified forest ecosystems suffer more damage from forest pests and are more likely to have problems regenerating effectively.

The primary focus of this chapter is on forest-dependent terrestrial and amphibious forms of wildlife. The intent is to provide practical, science-based guidelines to address a number of specific issues and projected impacts relating to forestry and wildlife. The resource directory contains Wisconsin DNR and non-Wisconsin DNR contacts that can provide additional information on management of all wildlife species.

Certainly, more can be done to enhance wildlife habitat or individual species than the steps recommended in these guidelines. Furthermore, each management practice, including the option to do nothing, will favor some species and hinder other species. As a result, it is not practical to provide a complete set of guidelines covering all possibilities for improving habitat in Wisconsin forests. Instead, these guidelines cover the essentials for addressing site-level issues related to forestry practices. Those interested in pursuing objectives that focus on wildlife habitats or natural communities are encouraged to consult a professional wildlife manager and/or ecologist for more information.

Figure 3-1: A deer trail meanders through a frost-covered opening. The retention of openings, created during forest operations, can help provide a mix of habitat conditions for many wildlife species. Other species, including some that are rare, rely mostly on unbroken, contiguous forest.

Remember that it is difficult to separate site-level and landscape-level issues. For wildlife, more than for other forest resources, what occurs on a site influences the surrounding landscape and vice versa. While the guidelines focus on the site level as much as possible, some of the more important "landscape implications" will also be discussed. Landscape-level wildlife needs can best be addressed through professional planning for individual properties and cooperation among landowners and agencies within a landscape.

Finally, many wildlife habitat guidelines can be applied simultaneously. For example, leave tree clumps in clearcuts might also serve as rare species buffers, provide mast production, and enhance vertical structure. These overlapping benefits may extend to other forest resources as well, such as for cultural resource protection and visual quality. In other cases, retention of various structural habitat components may create safety issues like the reduction of visual quality or increase the potential for pest damage. Other chapters of the guide will address some of the trade-offs that should be considered.

SPECIFIC WILDLIFE HABITAT GUIDELINES

Leave Trees and Snags

PURPOSE

The purpose of this habitat aspect is to provide for wildlife requiring perches, tree cavities, and bark-foraging sites through retention of suitable leave trees and snags on a site during forest harvesting and timber stand improvement. This guideline will also contribute to the continued presence of coarse woody debris on a site. For a more complete discussion of tree retention guidelines see Appendix A: Tree Marking and Retention Guidelines.

RATIONALE, BACKGROUND AND BENEFITS

In Wisconsin, up to 30 breeding birds, nearly 30 mammals, and several reptiles and amphibians use snags as breeding sites. Different species have adapted to different ecological conditions. Saw-whet owls utilize cavities in and around lowland conifer swamps, while red-headed woodpeckers nest in cavities in open or semi-forested conditions. The major issue for timber harvesting and cavity-dependent wildlife is whether suitable trees and nest cavities remain for these species following logging or timber stand improvement.

Retention of leave trees and snags during timber harvesting provides habitat for wildlife that require perches, tree cavities, or bark-foraging sites as the surrounding forest regenerates. Leave trees can be left scattered throughout a harvest area or in clumps as illustrated in Figure 3-10 (see page 3-18). The distribution and density of leave trees and snags will affect which wildlife species benefit from the practice. Leave trees can also impact regeneration after harvest. Snags and leave trees may also provide unique niches and microsites for a variety of plants, especially within retained clumps. Leave trees or snags that fall over and decay will also benefit soil conditions as well as wildlife that utilize coarse woody debris.

The fundamental idea is to retain some structure for snag- and cavity-dependent species on a site, or maintain the potential to produce such structure as a stand grows and develops (see Chapter 13: Timber Harvesting, for specific recommendations on leave tree and snag selection and distribution).

Cavity and snag trees are important statewide and are lacking in many stands. Wildlife species that use cavities range in size from small mammals such as bats and mice, up to black bears. A range of tree sizes and species is necessary on a landscape scale to provide for the full use of this habitat feature.

Openland or brushland management may require felling of all stems to reproduce open conditions needed in these habitats. However, some openland wildlife species require cavities. For example, eastern bluebirds will nest in single, scattered snags in an open landscape. Generally, dead standing stems do not detract from the establishment or maintenance of openland/brushland habitat. However, they may provide structure for some undesirable wildlife species in some situations. European starlings will nest in cavity trees in open or semi-forested landscapes if the site is adjacent or near an agricultural or urban/suburban setting. Starlings will out-compete other cavity nesting birds for this limited resource. In addition, if managing for openland species that are under severe predation pressure from raptors, consider removing all standing stems. If managing a site for oak savanna or pine/oak barrens habitats some level of tree retention is needed to maintain the community type.

Figure 3-2: Snags provide ideal conditions for wildlife requiring perches, tree cavities, and bark-foraging sites.

Figure 3-3: This strip of uncut pine provides a wildlife travel corridor through a clearcut area.

Cavity/snag trees are equally important in forested stands. There are a number of cavity-dependent species that require a larger forested acreage with sufficient canopy cover. Small mammals, bats and breeding birds that live in heavily forested areas also nest in cavities and use snags for foraging sites. black-capped chickadees and tufted titmice are only two of a number of charismatic forest bird species that nest in cavities. When conducting an uneven-aged harvest or even age thinning it is recommended to retain snag and cavity trees (see Appendix A: Tree Marking and Retention Guidelines). Barred owls and pileated woodpeckers utilize large cavities and snag trees, while downy woodpeckers and chickadees utilize smaller trees. In addition, these trees will also eventually topple and contribute to coarse woody debris on the forest floor.

LANDSCAPE IMPLICATIONS

Although these guidelines address site-level recommendations for snags and leave trees, the contribution of an individual site should be considered in the context of the surrounding landscape. Many of the cavity-dependent species being addressed have home ranges larger than the typical harvest unit, so planning for their needs requires a broader look, both spatially and temporally, at the larger forest community. Many other species have smaller home ranges than the typical harvest unit.

Coarse Woody Debris and Fine Woody Debris

PURPOSE

The purpose of coarse woody debris and fine woody debris is to provide cover, food or growing sites for a diverse group of organisms through the retention or creation of woody debris during forest management. Coarse woody debris and fine woody debris include existing down pieces of trees and branches, as well as the tops and slash of harvested trees. Snags and leave trees retained for other wildlife benefits become coarse woody debris as they deteriorate and fall. For a more complete discussion of tree retention guidelines see Appendix A: Tree Marking and Retention Guidelines.

RATIONALE, BACKGROUND AND BENEFITS

A wide variety of organisms benefit directly or indirectly from presence of woody debris. Small mammals dependent on downed logs and branches, in turn, provide food for mammalian carnivores and forest raptors (such as the pine marten and the broad-winged hawk). Amphibians such as wood frogs, four-toed salamanders, and red-backed salamanders utilize the cool, moist microsites created by woody debris as nesting/feeding areas.

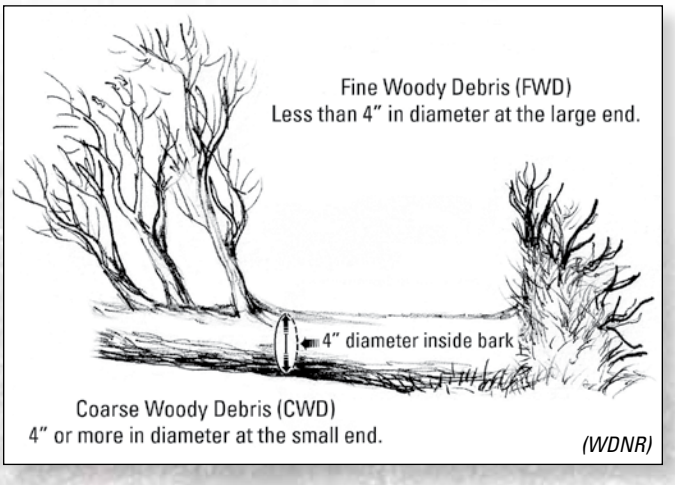


Figure 3-5: Generalized illustration of coarse and fine woody debris.

Figure 3-4: Coarse woody debris provides cover, food, habitat structure, and growing sites for many different animals and plants.

Woody detritus, like branches, twigs and leaves, reduces erosion and affects soil development, stores nutrients and water, is a major source of energy and nutrients, serves as a seedbed for plants, and is a major habitat for microbes, invertebrates and vertebrates. For example, yellow birch, white cedar and eastern hemlock regeneration is enhanced by woody debris. These tree species are important components of a diverse northern forest, and provide habitat for an untold number of vertebrate and invertebrate species. Bird researchers in northern Wisconsin found that hemlock dominated natural areas contained higher species diversity and richness than the even-aged managed hardwood sites that dominate much of the north.

The fundamental idea is to retain or enhance the amount of woody debris in a stand in order to benefit organisms associated with woody debris and to support nutrient cycles that benefit healthy forests (see Chapter 13: Timber Harvesting and *Wisconsin's Forestland Woody Biomass Harvesting Guidelines, Field Manual for Loggers, Landowners, and Land Managers*) for specific recommendations on woody debris).

Woody debris is important to forests and forest organisms statewide and is lacking in many stands. There are a number of species that utilize slash and coarse woody debris across the state. In the north, birds such as winter wrens and ruffed grouse utilize downed logs for nesting/feeding sites and for territorial displays. Blue-spotted or northern red-backed salamanders enjoy the moist, cool microsites provided by rotting logs on the forest floor. In the south, birds such as hooded warblers or Kentucky warblers may be taking advantage of the arthropods that live in and around coarse woody debris. Regardless of the location, coarse woody debris and slash is an important component of the forest ecosystem.

LANDSCAPE IMPLICATIONS

Although these guidelines address site-level recommendations for woody debris, the contribution of an individual site should be considered in the context of the surrounding landscape. Coarse woody debris left on a specific site may benefit reptiles and amphibians living there but breeding elsewhere. Thus, coarse woody debris placement might be influenced by off-site factors. For example, when managing a pine plantation, coarse woody debris may be important as a salamander migratory corridor between an adjacent hardwood forest and a wetland breeding site. However, if the pine plantation is bordered by other dry or arid cover types, and lacks wetlands of any type, coarse woody debris may not be important to salamanders at this site.

The size and position of intensive timber management may also determine the importance of coarse woody debris to associated organisms. For example, if a clearcut takes place surrounding a temporary wetland, coarse woody debris left in the clearcut and in the wetland would be essential habitat for breeding salamanders. Increased sunlight in the pond and harvested stand makes desiccation a problem for salamanders. Downed logs would provide cool, moist microsites enabling salamanders to avoid the desiccating effects of direct sunlight during the heat of the day. In addition, leaving downed logs would also provide drumming sites for ruffed grouse. If however, the clearcut was smaller and the wetland was bordered by older forest, coarse woody debris left in the clearcut may not be as important for salamanders. However, it still may perform other ecological functions important to the forested stand.

Conifer Retention and Regeneration

PURPOSE

The purpose of this aspect of habitat is to ensure diversity of wildlife habitat through the retention and regeneration of conifers for food, nesting and cover in mixed deciduous/coniferous stands. Conifers should continue to be a significant structural component in appropriate habitats and landscapes.

RATIONALE, BACKGROUND AND BENEFITS

Many wildlife species benefit from a mixture of conifer and deciduous trees and shrubs. Retaining young conifers, including isolated trees and scattered clumps, can provide habitat and food for many wildlife species, as well as a future seed source to promote conifer regeneration in harvested areas.

Various animal species, including the great gray owl, bald eagle, pine warbler, white-tailed deer, elk, pine marten, snowshoe hare, and red-backed vole depend on coniferous stands for structural attributes. Others – including spruce grouse, red-breasted nuthatch, red squirrel, porcupine, and elk – depend on food that coniferous stands provide. Deer and elk will often winter in conifer forests due to the reduced snow depths and thermal cover that these stands provide. Many species associated with the boreal forests of Canada reach the southern limits of their range in the coniferous and mixed coniferous forests of northern Wisconsin. Examples of these include American marten, fisher, Cape May warbler, Boreal chickadee, great gray owl, gray jay and palm warbler.

Historically, conifers often existed as scattered trees or clumps within most of northern Wisconsin's hardwood stands, although parts of the state had more extensive conifer-dominated areas. Many of these conifers have been lost due to poor regeneration following early logging. A number of species are adapted to scattered overstory conifers or patches of conifer within a hardwood stand. Pine warblers are often heard singing from scattered overstory white pines that persisted or regenerated within an oak or maple forest. Bald eagles or osprey often use scattered supercanopy trees as nesting or roosting sites. Often aspen/birch stands in northern Wisconsin contain patches of regenerating or mature white spruce or balsam fir. Birds such as Cape May warbler, magnolia warbler and Canada warbler will locate territories in and around these coniferous patches. These dense areas of conifer also provide thermal cover for grouse, deer and other northern species during cold winters and warm summers.

Retaining conifers in clumps is preferable to scattered trees. Clumps are more windfirm, provide better cover, are better potential seed sources due to improved pollination, and can withstand snow and ice loads more successfully (see Table 3-1, page 3-8).

These guidelines are most applicable to the northern part of the state. Certain portions of west-central and central Wisconsin contain areas dominated or co-dominated by white and Jack pine and may also benefit from these recommendations.

It is important to consider existing site conditions and silvicultural objectives when planning conifer retention and regeneration. Consult the Wisconsin DNR *Silviculture Handbook, 2431.5* or Wisconsin DNR staff for distributions of different conifer species within different ecological landscapes. Conifer regeneration and retention will work best if done in appropriate conditions and site locations. For example, retention and regeneration of pine fir and spruce in aspen/birch stands would be most appropriate on the Superior Coastal Plain and other areas of northern Wisconsin that historically supported a mixed aspen/spruce forest type often referred to as Boreal Forest. Retention and regeneration of white or red pines might be most effective in places like the Northern Highland or Central Sands Ecological landscapes, where white and red pines once dominated forest canopies, although white pine was found throughout much of the north, and there are opportunities in several of the northern Ecological Landscapes.

LANDSCAPE IMPLICATIONS

Although these guidelines address site-level recommendations for conifer retention and regeneration, the contribution of an individual site should be considered in the context of the surrounding landscape. When discussing conifer retention and its importance to wildlife, landscape scale management can be very important. Many species that utilize coniferous or mixed/coniferous woods have much larger home ranges than the particular stand being considered for management; therefore, it is important to take into account neighboring properties. In other situations, scattered leave trees or clumps of conifer regeneration will provide wildlife benefits, even when isolated from similar conditions.

If the stand being considered for management is bordered by coniferous forest, or if the region contains a large percentage of coniferous/mixed coniferous forest, then conifer retention or regeneration will have a greater likelihood of benefiting those species with larger home range needs or area requirements. Species such as Blackburnian warblers, Connecticut warblers or Cape May warblers will use conifers retained in managed areas if these landscape conditions are met. Often, small songbirds such as these will nest in loose colonies where extra-pair matings are an important part of the breeding strategy. Larger patches of habitat will increase chances that this mating system will work.

If the stand being considered for management is isolated from appropriate coniferous or mixed coniferous habitat, it will be of lesser value to those species needing large areas of this habitat. However, as discussed previously, other species may utilize smaller patches of coniferous regeneration. For example, small patches of thick fir or spruce may harbor wintering ruffed grouse or saw-whet owls. Scattered white pine canopy trees can be important nesting areas for pine warblers or bald eagles.

CONIFER SPECIES	EXAMPLES OF USES BY WILDLIFE
RED PINE	Mature trees may be used by raptors for perches or nest trees. Seeds are important mast for winter songbirds and red squirrels. Larger stands of mature trees provide breeding habitat for red crossbills, crossbills, pine warblers, Blackburnian warblers, and pine siskins. Mature stands with dense deciduous or coniferous understories can contain diverse breeding bird assemblages, including some rare species.
WHITE PINE	When young, provides good escape and severe winter cover for many species. High calorie, large seeds eaten by many small mammals and winter songbirds. Mature trees are important for cavity-dependent wildlife, preferred bald eagle nest trees, and escape trees for bears. Roosting trees for wild turkeys where present in central and southern Wisconsin.
JACK PINE	Great cover for a number of species when trees are young and stands well-stocked. Used as browse, mostly by spruce grouse. Seeds eaten by red squirrels and red crossbills. Persistent cones provide a year-round food source. Mature stands in northwestern Wisconsin home to rare Connecticut warbler. The federally endangered Kirtland's warbler uses young stands and has recently been found nesting in Wisconsin, with individuals documented in at least five counties.
BALSAM FIR	Important winter and summer cover for deer, elk and many species of birds. Birds eat seeds and use trees for nesting. When allowed to persist in hardwood understory, is important nesting cover for black-throated blue warblers and other bird species. Thermal cover for grouse and owls.
BLACK SPRUCE	Important escape and severe winter cover. Birds such as white-winged crossbills eat seeds and use trees for nesting. Buds and needles are important spruce grouse food. Often have diverse and abundant small mammal populations, which are important food sources for owls and other forest raptors. Black spruce wetlands contain many uncommon vertebrate and invertebrate species. Dead or dying trees often provide insects and snags for black-backed woodpeckers.
TAMARACK	Mature stands provide excellent habitat for owls and other birds. Snags are used as hunting singing perches. Seeds are eaten by small mammals, pine siskins and crossbills.
WHITE CEDAR	Mast is important food source for winter songbirds. Very important winter cover for deer. Important for browse during severe winters. Provides cover and cooling effect near water.
WHITE SPRUCE	Important seed source for winter finches. Summer nest cover for rare songbirds such as Cape May warbler and evening grosbeaks. Thermal cover for owls and grouse.
EASTERN RED CEDAR	Important winter cover in southern Wisconsin. Fleshy berry-like cones used by birds for food.
HEMLOCK	Hemlock-dominated forests or mixed stands contain distinct breeding bird assemblages not found in hardwood forests. Mature trees provide important owl roosting sites. Mast important to red squirrels and winter finches.

Table 3-1: Conifer Species and Examples of Use by Wildlife

Mast

PURPOSE

The purpose of this habitat aspect is to provide food for wildlife that utilize mast production from trees and shrubs.

RATIONALE, BACKGROUND AND BENEFITS

Many species of trees and shrubs have developed a seed dispersal system that benefits many species of wildlife. Producing mast in the form of nuts or berries encourages mammals such as squirrels or birds to eat or transport the seeds to other areas. Oaks may produce thousands of acorns in the hope that a blue jay or wild turkey will accidentally scratch one into the forest soil. Dogwoods and juneberries produce fruit attractive to migrating birds, which will pass the seeds to neighboring areas during migration. This complex reproductive strategy is essential to the inner workings of many ecological systems in Wisconsin.

High levels of fat, protein and carbohydrates in mast contribute to energy stores critical for migration or hibernation, and for survival of newly-independent young. Many birds that eat insects on breeding grounds will consume berries during fall migration. Yearly variations in mast production may impact subsequent reproductive success of many species. Often, plentiful mast production will lead to abundant small mammal populations, which in turn benefits forest carnivores that prey on small mammals. During winter, some sources of mast remain available to forest wildlife on trees and shrubs, under snow or stored in caches (see Table 3-2, page 3-10).

Mast production is generally favored by increased crown exposure to light, crown size, maturity of trees or shrubs, increased soil nutrients, tempered microclimates (especially during flowering), and adequate soil moisture. Production on a site tends to vary considerably from year to year.

Other considerations with respect to mast include:

- Mast-producing species often depend on animals for their dispersal and reproduction.
- Riparian edges often contain a higher concentration and richness of mast-producing species.
- Most shrub species will regenerate well and produce mast after cutting, burning or soil disturbance.

Although certain dominant tree species such as oak are particularly important for game species (e.g., deer or gray squirrels), other mast species also provide important benefits.

Retention of mast and other key food-producing tree types should be prioritized in accordance with the local abundance of each tree species. In areas of least abundance, greatest attention should be applied to retention. Planning silvicultural treatments to increase mast-producing trees should be performed in accordance with silvicultural guidelines laid out in the Wisconsin DNR *Silviculture Handbook, 2431.5* and Appendix A: Tree Marking and Retention Guidelines.

LANDSCAPE IMPLICATIONS

Although these guidelines address site-level recommendations for mast production, the contribution of an individual site should be considered in the context of the surrounding landscape. Land managers in regions with low mast availability have opportunities to enhance wildlife habitat characteristics by careful management of mast species on their land. Some wildlife species may travel significant distances to obtain mast. The black bear, for example, may travel 10 miles to obtain mast. Breeding birds will often relocate family groups to wetland edges or areas with increased levels of berries during late summer before migration. In areas with sufficient mast production, mast production may not be as important.

MAST SPECIES	EXAMPLES OF USES BY WILDLIFE
Oaks (acorns), beech and hazel nuts	Deer, bear, wild turkey, woodpeckers, blue jay, wood duck, squirrels, small mammals
Maple and ash seeds	Small mammals, evening and pine grosbeaks
Aspen, birch and hazel buds	Ruffed grouse
Yellow and white birch seeds	Common redpoll, pine siskin, American goldfinch
Conifer cones and seeds (such as white cedar, balsam fir, black spruce, white pine, common juniper, red cedar, Canada yew)	Red squirrels, white-winged and red crossbills, pine siskins, red-breasted nuthatch, pine grosbeak
Late summer soft mast (such as juneberries, blueberries, cherries, dogwoods, and elderberries)	Important to numerous birds and mammals as they prepare for migration and winter
Soft mast retained in fall and through winter (such as mountain ash, cranberry and nannyberry, winterberry)	Waxwings, pine grosbeaks, robin, and other bird and mammal species
Vines (such as wild grape)	Numerous bird and mammal species; bluebird, robin, cardinal, fox, raccoon, squirrels

Table 3-2: Examples of Mast-producing Plants that Will Benefit Wildlife in Wisconsin

Harvesting Patterns

PURPOSE

The purpose of this habitat aspect is to provide site- and landscape-level wildlife habitat requirements by using a variety of sizes and shapes of harvest areas. Understanding the impact from site-level management on the larger forested area will help land managers make better wildlife decisions.

RATIONALE, BACKGROUND AND BENEFITS

This management objective involves making silvicultural decisions on a landscape basis. Ideally, the management regime should range from the very fine-scale management represented by selection cutting to the coarse-scale management affected by sizable clearcuts. The size of clearcuts and other treatments should be determined by considering issues such as size of the management unit, the home range requirements of large animals, aesthetics, and natural disturbance regimes.

Although ownership considerations may preclude this, size and shape of both cut and uncut areas should mimic natural disturbance regimes, such as wind, fire, or disease that historically impacted the forest type to be managed. This will benefit the native species of plants and animals adapted to this forest type and disturbance regime. Larger patch sizes historically occurred under natural disturbance regimes on even-aged, fire-dependent types, such as Jack pine forests and associated barrens habitats. Large clearcuts in such types can function for a short time as habitat for some area sensitive openland species such as sharp-tailed grouse and upland sandpipers.

These managed areas will be of even greater benefit to openland species if they are placed adjacent to more permanent open barrens. Colonization of new openland habitat created by forest management is more likely to occur if it is adjacent to existing populations of openland species. As the managed area ages, it will become less attractive to openland species, but other early successional species such as eastern towhees and brown thrashers will colonize the site.

Smaller patches are appropriate in more heterogeneous forest types, such as deciduous forests on moraines. For example, northern mesic forests dominated by sugar maple, hemlock or beech were much more likely to undergo disturbance from wind than from large fires. Most wind events created smaller patchy canopy gaps within a larger forested matrix. Species like black-throated blue warblers nest within the thick regeneration generated by these disturbance events and could benefit from a silvicultural treatment that mimics this process in large forest blocks.

The shape and size of the cutting area determines the total amount of edge habitat created through management. An **edge** is defined as the transition area between two different forest types or successional stages. This transition zone can be "hard" (between a forested habitat and a field) or "soft" (between two age classes of forest habitat). "Hard" edges tend to be permanent, and may have more impact on wildlife than "soft" edges. "Soft" edges can also form as forest expands into open habitats. These "soft" edges differ from the regeneration found in canopy gaps by virtue of the amount and distribution of the regenerating age class. The amount and type of edge in a landscape will create conditions favorable for some species and detrimental to others. Many game species such as white-tailed deer and ruffed grouse, along with indigo buntings and chestnut-sided warblers, prefer the wide variety of cover and food resources found along forest edges and tend to be very good competitors for those resources. Landscapes with high amounts of natural or man-made edges tend to favor these edge species. However, many species of birds, some mammals and herps prefer the interior of larger (greater than 100 acres) blocks of forest. Cerulean warblers, Acadian flycatchers, hooded warblers, black-throated blue warblers, wood thrushes, and many other interior species are listed as endangered, threatened or special concern by the Bureau of Endangered Resources due to loss of appropriate habitat. A large increase in the amount of edge, through forest management activities or a natural disturbance in large blocks of forest, will increase edge species which will replace many interior species.

The soils, climate and geology of different locations across the state favor different types of forests. Each forest type and its associated wildlife are adapted to a particular disturbance regime. Ideally, forest management activities should take these disturbance regimes into account.

In general, more diverse and larger patch sizes are possible in northern Wisconsin than in the forest fragments of southernmost Wisconsin. Although there are notable areas with larger patches in the south such as parts of the Driftless Area and the Kettle Moraine, many of Wisconsin's southern forests have been converted to other uses, so special consideration should be given to conserving large patch sizes of existing forests in southern Wisconsin.

LANDSCAPE IMPLICATIONS

When employing large clearcuts, consider harvesting in segments over several years. This will provide both early successional diversity and, over the long-term, a large mature forest stand. Coordinate with adjacent landowners when natural stand boundaries cross property lines.

Figure 3-6: Two age classes of aspen, managed for grouse by clearcutting, illustrate the "edge" where two stands meet.

Endangered, Threatened and Special Concern Species

PURPOSE

The purpose of this section is to increase awareness of endangered, threatened and special concern species (ETS species) and the need to maintain or enhance populations of these species. This section will also help to increase awareness of statewide forest policies to consider endangered, threatened and special concern species in the forest management decision-making process.

RATIONALE, BACKGROUND AND BENEFITS

By definition, ETS species are rare. The Wisconsin DNR tracks 933 species of animals, vascular plants, and non-vascular plants on the Natural Heritage Inventory Working List. Of these, 233 are listed as Endangered or Threatened and protected by the state's Endangered Species Law; the others are designated as Special Concern. Most of the animals on the Working List are also considered Species of Greatest Conservation Need from the Wisconsin Wildlife Action Plan.

Sustainable forestry includes consideration for rare (ETS) species and their habitats using the best information available. All species found in a natural forest play important roles in ecosystem health and function, and the Wisconsin DNR mission reflects the importance of maintaining biodiversity. Below are some of the reasons for considering the full suite of species in an area during planning and management activities:

- Conservation of species for their innate values.
- Conservation of rare species that play a critical role in ecosystem function.
- Conservation of nutrient recycling and soil enhancing animals and fungi.
- Conservation of natural disturbance regimes.
- Deter invasion by aggressive, non-native invasive species.
- Conservation of genetic strains that are adapted to local climate and site conditions.
- Conservation of aesthetic and recreational values.
- Conservation of species that may produce economically-valuable products or provide eco-tourism benefits.
- Scientific and educational benefits.

PROTECTION AND MANAGEMENT

The presence of ETS species does not preclude most forest management activities. Often timber sales can accommodate rare species through modifications such as the timing of harvests, buffering nest locations, strategically locating gaps and residuals, locations of landings and roads, and careful planning of post-harvest treatments. The guidelines outlined throughout this chapter cover important forest characteristics that should contribute to many rare species habitats. As with other planning activities, considering both 1) a site's relationship to the surrounding landscape and 2) whether the site provides unique contributions to that landscape is important for biodiversity. Maintaining reserve areas in the state is critical, but how working lands are managed is just as important to Wisconsin's biodiversity as a whole.

Many forest ETS species can be found in specialized habitats, some of which are easy to accommodate Seeps, ephemeral ponds (vernal pools), cliffs, extensive bogs and other wetlands, older forests, and large blocks of southern Wisconsin dry-mesic and floodplain forests harbor many forested ETS species. Many species are localized in their distribution and may be known from only certain landscapes or sites within the state.

Existing research and monitoring provide some forest management guidance for rare vertebrates, although many questions remain unanswered, and treatments must be considered within the context of the surrounding landscape. Comparatively little is known about the impacts of timber harvest on rare plants, and many invertebrates lack even the most basic life history information, making management decisions challenging. Long-lived and slow-dispersing understory plants and invertebrates, especially those that have their optimum habitat in late-successional or older forest, may be particularly sensitive to timber harvests, so it is important to adequately monitor the effects of management wherever possible.

Figure 3-7: Cavity trees enhance the quality of wildlife habitat.

Figure 3-8: Eagle nest in the top of a white pine tree. Leaving trees like this provide ideal sites for nesting.

Forestry projects are subject to ETS laws, and screening for ETS species can help comply with laws and conserve biodiversity. All projects that the Wisconsin DNR conducts, funds, or approves are screened (e.g., management plans and timber sales on Managed Forest Law [MFL] lands). Department foresters routinely use Natural Heritage Inventory data and other information to screen for potential impacts when writing management plans and setting up timber sales to comply with laws, Forest Certification requirements and department policy.

LEGAL PROTECTION

Endangered and threatened species are protected in Wisconsin by one or more of the following laws: the Federal Endangered Species Act of 1973 (Public Law 100-478), Lacey Act, Migratory Bird Treaty Act, Bald Eagle Protection Act, Wisconsin Endangered and Threatened Species Law (State Statute 29.604 and Administrative Rule NR 27), Protected Wild Animal Law (Administrative Rule NR 10.02), and the Wisconsin Non-game Species regulations (State Statute 29.039).

Other laws, both state and federal, may apply to the protection of plants and animals in the state. Specific information may be obtained from your local Wisconsin DNR office, or the Bureau of Endangered Resources Program (see the Resource Directory).

Additional resources on ETS Species include:

- The Natural Heritage Inventory Working List for Wisconsin, **http://dnr.wi.gov/org/land/er/wlist/**
- Endangered Resources Program web pages, especially the Species and Communities pages, **http://dnr.wi.gov/org/land/er/biodiversity/**
- The Ecological Landscapes Handbook is currently in preparation and will contain a great deal of useful information for applying ecosystem management each of Wisconsin's 16 Ecological Landscapes, **http://dnr.wi.gov/landscapes/**
- The Wisconsin Wildlife Action Plan lists the Species of Greatest Conservation Need in Wisconsin and the natural communities and Ecological Landscapes that are important for each species. Important "Conservation Opportunity Areas" have also been identified using information from the plan, **http://dnr.wi.gov/org/land/er/wwap/**
- Local Wisconsin DNR biologists, ecologists, conservation wardens, foresters, park managers, or naturalists.
- Nature centers, colleges and universities, and University of Wisconsin-Extension offices

PRIVATE LANDS FREQUENTLY ASKED QUESTIONS

1. What does it mean when rare (ETS) species are found on my land? *It means you have land that is quite different from most properties in the state. Native species that have been eliminated elsewhere still find a home on your land. You may have some legal obligations, but there may also be some benefits.*

2. How do I know if there is a rare species on my land? *Wisconsin DNR or U.S. Fish and Wildlife Service biologists may be able to assist you in determining if rare species are present on your property. For properties in MFL, the department requires a search of the Natural Heritage Inventory Database when a forester develops a management plan or sets up a timber sale. Although this database is our best information source for occurrences of rare species, most private lands in Wisconsin have not been inventoried, so there may be rare species on your land that have not been documented.*

If rare species are found on your property, that information is shared with you but is otherwise confidential. The Wisconsin DNR wants to encourage and help landowners protect and manage for these rare species, while still respecting your rights as a private property owner. In addition, the federal government offers many flexible tools that promote the conservation of rare species, while accommodating the land use plans of the private landowner.

You can get more information about the status and distribution of rare species, or learn what species or natural communities are known from Wisconsin through the Bureau of Endangered Resources web pages, ***http://dnr.wi.gov/org/land/er/****.*

3. What is the difference between endangered, threatened and special concern species? *Endangered means the species is in danger of becoming extinct. Threatened means the species is less vulnerable, but could become endangered. There are separate state and federal threatened and endangered species lists. "Special Concern" species are also tracked by the Wisconsin DNR and are suspected to be in danger of becoming threatened or endangered, although there is not enough data to know for sure at this time. See the Working List for more information,* ***http://dnr.wi.gov/org/land/er/wlist/****.*

4. What if the species are plants? *Plants found on private property belong to the landowner, as plants are only legally protected on public lands or private lands where federal funds are used. Of course, the Wisconsin DNR wants to encourage protection of rare plants and help the landowner manage them, as they are important to the state's biodiversity. In addition, Forest Certification programs may require rare plants be accommodated in some way.*

5. What if the rare species are birds or other animals? *Because animals can travel freely from one property to another, they belong to everyone. State and federal laws determine what anyone can do with these species. For example, it is illegal to shoot a timber wolf in Wisconsin, although it is not illegal to shoot a white-tailed deer in season. Laws also protect nesting birds or turtles from being disturbed during the nesting season.*

6. How does a landowner benefit from the knowledge that an ETS species occurs on their property? *You learn from biologists what makes your property special. You may get help with managing the natural resources on your land. Several programs are in place that can provide tax advantages or cost-sharing for management.*

7. Will I still be able to use my property for timber harvest or recreation? *Many ecosystem-based, sustainable forestry activities do not negatively impact threatened or endangered species. Many forms of recreation and land uses are also compatible with the protection of rare species. For example, managing white-tailed deer populations through hunting can be important for reducing deer damage to rare species and their habitat. Situations may arise when there are conflicts between recreation or land management practices and the protection of rare species, but there are usually workable solutions.*

Natural Communities, High Conservation Value Forests, and State Natural Areas

PURPOSE

The purpose of this section is to increase awareness of Wisconsin's natural communities, including both representative and rare types. The relationship between high-quality natural community examples, High-conservation Value Forests and State Natural Areas is discussed.

RATIONALE, BACKGROUND AND BENEFITS

A **natural community** is an assemblage of plant and animal species occurring together at a given place and time. The Wisconsin Natural Heritage Inventory uses a system based on groups of plant species that differs from other commonly used forestry classification methods such as cover types (based on dominant tree species) and forest habitat types (focused on potential climax species). Although designed for different purposes, all of these systems can be used compatibly.

The Wisconsin Natural Heritage Inventory (NHI) Program was established in 1985 through state statute (23.27) to identify natural areas meeting a critical level of importance in the state. Although the NHI program regularly conducts surveys throughout the state, much of the state has not been surveyed for the presence of high-quality natural communities, including most private lands.

High-quality natural community types are identified based on certain features such as size, context, condition, species present, and amount of disturbance. The NHI program uses standard methods for evaluating natural community quality. High-quality examples of many forested community types are scarce in much of the state, even for natural community types that are, themselves, widespread. For example, northern mesic forests cover much of northern Wisconsin, yet most examples lack older trees, coarse woody debris, undisturbed groundlayer, and other structural characteristics. For some of Wisconsin's widely distributed community types, older developmental stages are becoming increasingly less common based on forest inventory data from the last 20+ years. High-quality natural communities are sometimes used to locate areas of potentially high biodiversity.

Rare natural community types are usually localized and can be geographically restricted to small portions of the state. There are only a few rare forested natural community types, and they often occur within larger forests or in close association with other more common types. Most examples of these types, unless thoroughly degraded, are inherently valuable to biodiversity because of their scarceness. Examples of rare natural community types sometimes associated with forests include oak openings, bedrock glade and algific talus slopes.

High-conservation Value Forests (HCVFs) possess exceptional ecological qualities. High-quality examples of natural communities, rare natural communities, or areas of otherwise high importance to biodiversity are often primary reasons for identifying HCVFs in Wisconsin. Maintaining HCVFs on a property can be important for biodiversity, as well as for research, monitoring, and comparison to other nearby areas. Some HCVFs are managed using special ecologically-based objectives; others are designated as long-term reference areas such as Wisconsin's State Natural Areas.

State Natural Areas (SNA) are officially recognized tracts of land or aquatic natural features which have experienced the least intrusive levels of human disturbance. They contain outstanding examples of native biotic communities and are often the last refuges in the state for certain ETS species. SNAs may also include exceptional geological features. Wisconsin's SNAs and other reserve areas allow us to better understand the ecology of forests with little past disturbance, and they provide important "benchmarks" to compare to our managed forests. Many SNAs and reserves are maintained passively, while other sites are maintained by fire or with appropriate silvicultural techniques.

The presence of rare and high-quality natural communities, HCVFs, and natural areas can provide many benefits for the landowner and citizens of the state:

- Protect habitat for ETS species.
- Provide reference areas to compare the effects of more intensively managed areas. Best used in an adaptive management situation and often times can accommodate some active management.
- Provide opportunities for scientific research where natural processes are allowed to proceed essentially unimpeded.
- Provide opportunities for formal and informal education to gain an appreciation and understanding of biotic communities and their component species.
- Apply the principles of ecosystem management to the forest.
- Provide areas which are managed more intensively (barrens and savanna) or less intensively (late succession to old-growth forest) than normal sustainable forest practices.
- Protect significant geological features.
- Provide a reservoir of genetic and biological diversity.

FORESTED NATURAL COMMUNITY TYPES

The following are brief descriptions for Wisconsin's forested natural community types, along with some considerations for identifying areas with high conservation value. Old forests with trees beyond economic rotation age, especially in combination with other ecological features, are important conservation opportunities in all of the types because of their general rarity and continued decline. Size, context, condition, degree of impact by invasive species, and deer browse are important to consider for any of these types.

The presence of special microsites such as seeps, springs, ephemeral ponds, and cliffs contribute to the ecological value of a site. Although not described here, these features are often embedded within larger forested areas and can be accommodated during routine management of the surrounding stands.

These are only short descriptions meant to increase awareness. The reader is also encouraged to see the Bureau of Endangered Resources natural communities web pages, **http://dnr.wi.gov/org/land/er/communities/**.

- **Black Spruce Swamp:** Characterized as a conifer swamp with high canopy closure dominated by black spruce. Significant examples have intact hydrology, are large in extent, or are found in association with a diverse array of other wetland types.
- **Bog Relict:** This geographically limited community is found south of the tension zone in Wisconsin and is often dominated by tamarack. It can contain many of the more widespread bog species found in the northern half of the state. These relicts are typically isolated from each other and can contain rare species. Avoiding impacts to hydrology and avoiding isolation of these small communities are important conservation opportunities.
- **Boreal Forest:** A forested community dominated by white spruce and balsam fir, often mixed with white cedar, white pine, and paper birch that is limited to areas near the Great Lakes. Mature examples are rare in Wisconsin, and old-growth examples are virtually non-existent except for a handful of relicts. Conservation opportunities will often require active restoration techniques to replace conifer species.
- **Central Sands Pine-oak Forest:** This geographically limited natural community is found in the Central Sand Plains Ecological Landscape and characterized by a diverse canopy of red pine, white pine, several oak species, and red maple. The ground layer is sparse – mostly Penn sedge and blueberries. Large blocks and older age classes would be of highest ecological importance.

- **Floodplain Forest:** Also known as bottomland hardwoods, this type is found along portions of large rivers. Characteristic trees include silver maple, river birch, green ash, hackberry, cottonwood, swamp white oak, and formerly elms. These forests are very diverse and larger patches can provide habitat for numerous rare species. Ecologically important sites contain older trees with intact hydrology and upland buffers. The best examples would have relatively unrestricted flood pulse events.
- **Great Lakes Ridge and Swale:** This forested community complex is restricted to a narrow fringe along the Great Lakes, and formed on old dunes and beach ridges created during past high water events. It contains exceptionally diverse habitats and requires protection to maintain its ecological connections.
- **Hemlock Relict:** These are isolated hemlock stands occurring in deep moist ravines or on cool, north an east-facing slopes in southwestern Wisconsin. These relicts are very rare with extremely small opportunities for enhancement, expansion, or reproduction. Unusual plants and animals have been documented in a number of stands. Existing remnants should be considered for special management designation.
- **Mesic Cedar Forest:** This is a rare upland forest community limited to few mesic sites in northern Wisconsin, characterized by white cedar as a co-dominant tree. Associates include hemlock, white spruce, yellow birch, and white pine. All stands of this type are rare and should be considered for special management designation.
- **Mesic Floodplain Forest:** A very rare natural forest community found on alluvial terraces of streams flowing into Lake Superior. This forest is characterized by typical northern hardwood in the canopy, but the ground layer has an exceptionally diverse spring ephemeral flora with many southern species expanding beyond their typical range limit. These rare isolated terraces should be considered for special management designation.

Figure 3-9: A bald eagle resting on a white pine branch in northern Wisconsin.

- **Northern Dry Forest:** This relatively common forest community of the northern sand counties is characterized by the presence of Jack pine, Hill's oak and occasional red pine. Stands of special ecological interest are often generated after a catastrophic fire, have older age classes with many openings, and can be managed using prescribed fire. This community can occur in close association with Pine Barrens, a globally rare community type that harbors numerous ETS.
- **Northern Dry-mesic Forest:** A common forested natural community type dominated by various combinations of white pine, red pine, red oak, and red maple. Stands of special ecological interest are older, large in extent, and of natural origin with a special emphasis on those stands where continued fire management is possible.
- **Northern Hardwood Swamp:** This forested natural community is found along lakes, streams and isolated basins and is dominated by black ash, sometimes with significant components of red maple and yellow birch. Sites of special ecological interest are large blocks of mature forest with intact hydrology. This type is threatened by emerald ash borer, as black ash often comprises the majority of the overstory.

- **Northern Mesic Forest**: A broad natural community type that combines northern hardwood and hemlock cover types. This is the most common natural community type in the north. Stands with the most ecological significance are within large blocks and contain mature trees, numerous tip-up mounds, abundant coarse woody debris, and intact ground flora. The majority of the HCVF examples currently maintained as SNAs or with other special management designations are hemlock-dominated and not species rich. Mature, more mesic examples with a rich ground flora are conservation priorities for Wisconsin.
- **Northern Wet Forest:** Roughly equivalent to the swamp conifer cover type, this forest is dominated by black spruce, tamarack and occasionally Jack pine in some parts of the state. Stands of special ecological significance are mature with a nearly continuous canopy and intact hydrology.

Figure 3-10: Numerous "islands" of uncut trees in this clearcut stand, along with scalloped edges, provide good wildlife habitat and improved visual impact after timber harvesting.

- **Northern Wet-mesic Forest:** Roughly equivalent to the white cedar cover type, this natural forest community is dominated by white cedar, but also has significant balsam fir, black ash and spruces in the canopy. Many uncommon species are associated with this type. Most stands have a special ecological significance due to the confounding effect of deer on white cedar regeneration. Until effective cedar replacement can be assured, most stands should be considered for special management emphasis to maintain the type on the landscape.
- **Oak Woodland:** Once relatively common on Wisconsin's landscape, this natural forest community roughly intermediate in structure between oak opening and southern dry forest, is now virtually non-existent. Ecologically significant sites are limited to active restoration efforts. Sites should be evaluated for canopy structure, remnant oak woodland ground layer species, and the potential for long-term fire management. Contact a department ecologist for assistance with site evaluations.
- **Pine Relict:** Similar to hemlock relict, these conifer dominated communities are found in isolated locations in the driftless area of southwestern Wisconsin. This natural community has red pine, white pine and occasionally Jack pine as the dominants, and is found on sandstone or dolomite outcrops. Regeneration is often problematic and should be attempted only with great care. Large examples are of high conservation significance.
- **Southern Dry Forest:** This natural forest community represents the oak cover type found on dry, especially sandy, sites. White oak and black oak are the dominants, and often red oak and black cherry are associates. Shrubs are well-developed and diverse. Sites with special ecological significance are large blocks of mature forest with standing and fallen dead trees. There may be good opportunities to manage these areas in close association with savannas, restored prairies, and surrogate grasslands.

- **Southern Dry-mesic Forest:** Most closely associated with the red oak or central hardwoods cover types, this natural community is dominated by red oak with significant inclusions of white oak, basswood, sugar maple, red maple, and white ash. Sites with special ecological significance are large blocks of mature forest with numerous tip-up mounds, cavities, and coarse woody debris.
- **Southern Hardwood Swamp:** This natural community is associated with isolated basins in glaciated southeastern Wisconsin and was probably never widespread in Wisconsin. Common dominants are red maple and green ash, as American elm is now rare. This natural community is rarely found in an unmanipulated condition. Sites with special ecological significance are those with intact hydrology and few invasive exotics such as buckthorns, honeysuckle and reed canary grass common to many wetlands in this part of the state.
- **Southern Mesic Forest:** This natural forest community can be confusing, because it is analogous to the northern hardwood cover types. However, it's found primarily south of the tension zone and usually has much different ground layer species than northern hardwoods north of the tension zone. Stands with the most ecological significance are large blocks of mature forest with abundant coarse woody debris and few invasive species.
- **Tamarack (Poor) Swamp:** This natural community is a broken or closed canopy tamarack swamp growing under limited influence of mineral enriched water. Alder is a common associate in the shrub layer. The understory is more diverse than Black Spruce Swamps and may include more nutrient-demanding species. The best example would be large and contiguous with an intact hydrology.
- **Tamarack (Rich) Swamp:** This geographically limited forested wetland community is found south of the tension zone. The relicts have many northern species and have sustained severe alteration due to water level manipulation. This natural community type is rare, often declining, and should be considered for special management designation.
- **White Pine/Red Maple Swamp:** This geographically limited swamp community is restricted to the margins of the bed of extinct glacial Lake Wisconsin. It often occurs along headwater streams and seepage areas on gentle slopes. White pine and red maple are the dominants. This very rare natural community has few examples in reserve or HCVF status and more examples should be considered for special management designation.

Figure 3-11: Coarse woody debris in riparian and upland forests provide great habitat for nesting and foraging salamanders, small mammals, and birds such as this Cape May warbler.

FIELD SURVEY CONSULTANTS AND OTHER RESOURCES

The following resources may be able to assist in field surveys to identify High Conservation Value Forests and rare natural communities:

- Wisconsin DNR Natural Areas staff, ecologists, heritage zoologists, heritage botanists, non-game specialists, forest ecologists, or wildlife managers (see the Resource Directory).
- Local wildlife biologists, foresters, park managers or naturalists.

Ephemeral Ponds

PURPOSE

Ephemeral ponds within forests provide habitat for several animal and plant species.

RATIONALE, BACKGROUND AND BENEFITS

Wisconsin has an abundant variety of wetlands and the mixture of land and water features across the landscape provides an important dimension to the habitats of many wildlife species. Ephemeral ponds, a type of wetland, provide important habitat for many wildlife species in Wisconsin's forests.

Ephemeral ponds are more than puddles. They support populations of invertebrates that consume forest litter that falls into the depressions. Some invertebrates, such as fairy shrimp, are specifically adapted to the short-lived nature of these seasonal ponds and never leave a particular pond. Invertebrates found in ephemeral ponds provide food for birds, mammals, amphibians, and other species that are sought after by larger animals. Red-shouldered hawks, a threatened species in Wisconsin, often chooses forested areas that contain a number of ephemeral ponds to ensure an adequate supply of prey for rearing young. Ephemeral ponds also provide an important source of spring food for breeding waterfowl and migrating birds.

Amphibians are important components of many forest ecosystems, and many depend on ephemeral wetlands for breeding habitat. These temporary or seasonal wetlands are important to amphibians because they do not contain fish populations which prey on salamander eggs. Blue-spotted and spotted salamanders will enter these ephemeral wetlands as soon as they lose their ice cover in spring. Pay attention to roadsides during the first warm rain of spring, and you will literally see the forest floor crawling with salamanders traveling to breeding sites. Five species of frogs are also heavy users of wetland inclusions. Anyone who has walked along a forest road at night can recall the croaking of wood frogs, the peeping of spring peepers, and the distinctive notes of chorus frogs. Frog songs can be so loud in these ephemeral ponds that they block out all other sounds. Later in the spring and early summer, Cope's and eastern gray tree frogs use these wetlands for breeding. Because of the high biomass of amphibians in forested habitats, they are extremely important both as predators of invertebrates, and as prey for other forest wildlife species. Some amphibians have been shown to demonstrate high site fidelity and often return to the same breeding pond.

Ephemeral ponds are easiest to identify in spring when they are full of melt-water from the spring runoff. Frogs calling in spring, vegetation, or topography might provide additional clues to their location.

Applying guidelines for water quality and retaining leave trees, snags, coarse woody debris, and slash during forest management activities provides key habitat features (including woody debris, litter depth and plant cover) in these areas, while preventing siltation, excessive warming, or premature drying-up of ephemeral ponds. Providing coarse woody debris in the stand surrounding a pond can provide valuable habitat for amphibians.

THE NEED FOR RESEARCH AND MONITORING

Even though the ecological importance of ephemeral ponds has become nationally well-recognized, the total number and location of all such wetlands in Wisconsin's forests is unknown. Existing inventories, such as the National Wetland Inventory, are incomplete with regard to wetland inclusions. Furthermore, ephemeral ponds are sometimes difficult to recognize in the field. Uncertainty regarding the abundance and location of ephemeral ponds indicates the need to document their occurrence, and further research their role in forest ecology in Wisconsin.

EPHEMERAL PONDS

- **Ephemeral ponds** are also called seasonal ponds or vernal pools.
- Ephemeral ponds are wetland depressions that temporarily hold water in spring, early summer and after heavy rains. They typically dry up by mid to late summer.
- Ephemeral ponds do not have an inlet or outlet, and are not connected to lakes or streams
- Ephemeral ponds do not support fish, offering important habitat for many amphibians.

Important clues for identifying ephemeral ponds include:

- An identifiable edge caused by annual flooding and local topography, usually with sparse vegetation in the depression itself.
- Standing water during the spring or fall, but it may be identified during dry periods by the lack of forest litter in the depression, or water stains or a layer of sediment on leaves.
- Wetland plants, like black ash and marsh marigolds, can sometimes be found in or around the depression.

NOTE: Replenished annually, leaf litter is consumed during inundated periods, and noticeably depleted thereafter. Deciduous litter will likely be consumed faster and more thoroughly than conifer litter.

Riparian Wildlife Habitat

PURPOSE

The purpose of riparian wildlife habitat is to provide site-level wildlife habitat features for species that utilize riparian ecosystems.

RATIONALE, BACKGROUND AND BENEFITS

Riparian areas are among the most important parts of forest ecosystems. These areas have high plant diversity, both horizontally and vertically from the water's edge, which contributes to the high diversity of animals that live in these areas. Up to 134 vertebrate species occur in riparian forests in this region, but many of these species will also use non-riparian forest habitat. The species that are of most concern in riparian areas are "obligate" species, which require both the water and surrounding forests as habitat. In Wisconsin, obligate riparian species include amphibians, reptiles, birds, and mammals. Numerous plant and invertebrate species are also strongly associated with these habitats. Different animals are associated with different stream sizes. In general, larger animals are associated with larger streams and smaller species with smaller streams. A reverse pattern is found in some salamanders.

Although some degree of mature forest cover is desirable along many riparian areas, all habitat conditions are valid, given long-term disturbance regimes. Some wildlife species, such as woodcock, require dense woody cover that can be provided by young forest or shrub cover in riparian areas. The greatest concern for riparian habitats is in those areas of the state where uplands have been converted to agriculture, resulting in little additional forest of any kind in the region. This situation occurs more in the southeastern and western portions of the state rather than in the north, which affords more flexibility in age classes, structures and cover type (see Chapter 5: Riparian Areas and Wetlands, for specific BMPs and harvesting criteria for riparian zones).

Forest streams come in many sizes, growing from spring-fed trickles to large rivers as they move downhill, and converge with one another to drain larger and larger watersheds. Along this gradient, the ecological characteristics of a riparian area change in a gradual continuum. Because of these characteristics, management guidelines for riparian areas in general should be considered on a landscape level.

It is important to keep in mind the following wildlife-related concerns for riparian habitats:

- **Leave Trees and Snags**
  - Prothonotary warblers, tufted titmice, wood ducks, and a number of other species are dependent on existing cavities in riparian forests. Woodpeckers and chickadees select dying or diseased trees in which to excavate cavities. It is important to leave existing cavity trees and potential snags for use by the many cavity nesters that utilize riparian forests.
  - Some riparian species require large super-canopy trees (trees above the existing canopy) for hunting perches and nesting sites. On larger rivers, osprey will often perch in a large, dead white pine above a river to look for prey.
  - Shade is essential for maintaining microhabitat conditions for some riparian animals. Winter wrens, northern waterthrushes and many salamanders like the cool, moist conditions created by a closed canopy riparian forest. Yellow warblers, willow flycatchers and some herps need more open riparian conditions. Providing a range of seral stages where appropriate will benefit a number of riparian species.
- **Coarse Woody Debris and Slash**
  - Many riparian animal species require downed logs for cover. Downed logs and slash in riparian areas provides additional microsites for insects and the species that prey on these insects. Salamanders, frogs and small mammals utilize these large logs as travel routes to avoid predation.

Figure 3-12: Wild lupine in central Wisconsin; the Karner blue butterfly's only known larval food plant. The Karner blue is listed as an endangered species, even though they are relatively abundant in parts of Wisconsin.

- **Mast**
  - Riparian edges often contain a higher concentration and richness of unique mast species, especially shrubs, than adjacent upland areas. It is well-documented that riparian areas are critical migratory stopover locations for birds that winter in the Neotropics. These areas often have more insect life in the spring before leafout than associated uplands. In the fall, dogwoods, nannyberry, wahoo, honeysuckle, elderberry, and other mast-producing shrubs and trees provide nourishment to birds migrating south and other species preparing for winter.

Figure 3-13: Large blocks of older forest are important to forest interior species such as this cerulean warbler.

- **ETS Species**
  - Many ETS species are found in riparian areas.
  - Many of the bigger blocks of forest in the southern half of Wisconsin occur in riparian zones along the larger rivers. These are important areas for forest interior species such as red-shouldered hawks, cerulean warblers, Acadian flycatchers, yellow-throated warblers, yellow-crowned night heron, and a host of other species found in the southern half of the state.
  - High-quality streams and rivers are important habitat for many rare dragonflies, fish, mussels and clams, and other invertebrates. Often the presence of these species is used to evaluate stream health. The middle St. Croix, middle and lower Chippewa, and lower Wisconsin are good examples of riparian systems that host many rare species.

- **Natural Communities and Sensitive Sites**
  - Many natural communities are associated with riparian ecosystems. Some, like floodplain forests, are always associated with riparian areas. Others, such as northern sedge meadow, emergent aquatic, and alder thicket are often associated with riparian areas, but can also be found in other situations. For a complete listing and description of natural community types in Wisconsin, see the Endangered Resources Natural Community Web pages.

These guidelines are applicable statewide.

LANDSCAPE IMPLICATIONS

In areas dominated by agricultural landuse practices (in southern and east-central regions), where riparian forests represent the majority of the forests in the area, consider using uneven-aged management. Most rare species associated with these forests require high-canopy closure and large blocks of forest.

ETS SPECIES ASSOCIATED WITH RIPARIAN ECOSYSTEMS

- Red-shouldered hawk[2]
- Cerulean warbler[2]
- Yellow-crowned night heron[2]
- Western ribbon snake[2]
- Yellow-throated warbler[1]
- Northern cricket frog[1]
- American bullfrog[3]
- Prothonotary warbler[3]
- Smooth softshell turtle[3]
- Louisiana waterthrush[3]
- Many rare mussels and clams
- Osprey[3]
- Acadian flycatcher[2]
- Wood turtle[2]
- Great egret[2]
- Snowy egret[2]
- Bald eagle[3]
- Massassauga rattlesnake[1, 4]
- Many rare fish species
- St. Croix snaketail, splendid clubtail and a host of other rare dragonflies
- Numerous other plants, snails and invertebrates

1 Endangered – 2 Threatened – 3 Special Concern – 4 Candidate for Federal Listing

Figure 3-14: This stand of red pine has been thinned three times, and the shrub layer resulting from increased sunlight reaching the forest floor now provides good wildlife habitat.

RESOURCES FOR ADDITIONAL INFORMATION

These resources are specific to the information in this chapter only. Refer to the Resource Directory for additional resources related to this chapter.

ENDANGERED RESOURCES PROGRAM WEB PAGES

Housed on the Wisconsin DNR web site, these pages provide a wealth of information on rare species, natural communities, the State Natural Areas Program, Invasive Species, the Wisconsin Wildlife Action Plan, and Bureau of Endangered Resources related news and events, **http://dnr.wi.gov/org/land/er/**. A subset of these pages contains life history and identification tips for numerous species, descriptions of natural community types, county-level occurrence maps, and links to related information: **http://dnr.wi.gov/org/land/er/biodiversity/**. These pages have replaced several earlier printed publications and are now the department's primary source of information for rare species and natural community information for department staff and the general public.

FOREST AND BIODIVERSITY BOOKS

These publications describe important ecological concepts as they relate to forest management. They are excellent references for either the practicing forester or biologist and include ways to provide for biodiversity within the context of a working landscape.

- *Conserving Forest Diversity: A Comprehensive Multiscaled Approach.* Lindenmayer, D. B. and Franklin, J. F., Washington: Island Press, 2002.
- *Maintaining Biodiversity in Forest Ecosystems.* Hunter, M. L., Jr. (Editor), Cambridge, England: Cambridge University Press, 1999.
- *National Commission on Science for Sustainable Forestry.* National Council for Science and the Environment, Washington D. C., 2007. Conserving biodiversity through sustainable forestry. **www.ncseonline.org/NCSSF/**
- *Wildlife, Forests, and Forestry: Principles of Managing Forests for Biological Diversity (2nd Edition).* Hunter, M. L., Jr. and F. Schmiegelow, 2010: Prentice-Hall, In Press: Englewood Cliffs, New Jersey.

HERPS OF WISCONSIN BOOKS

These publications provide an overview of biology and conservation, including a description and brief habitat information for amphibians, snakes, turtles and lizards of Wisconsin.

- *Amphibians of Wisconsin.* Bureau of Endangered Resources, Publication Number ER-105 2009, Wisconsin DNR, Madison, Wisconsin, 2009.
- *Snakes of Wisconsin (2nd Edition).* Wisconsin DNR Bureau of Endangered Resources, Publication Number ER-100 2008, 2008.
- *Turtles and Lizards of Wisconsin.* Wisconsin DNR Bureau of Endangered Resources, Publication Number ER-104 2002, 2002.

NATURAL HERITAGE INVENTORY DATA

The Wisconsin Natural Heritage Inventory (NHI) database contains status and distribution information for rare species and high-quality natural communities. Access to NHI data requires a license agreement with the department. There are also ways to access general NHI data for information and general planning purposes. General data are not sufficient for regulatory purposes. For more information on NHI data, see the department web page entitled "Accessing NHI data," **http://dnr.wi.gov/org/land/er/review/access_nhi.htm**

RUFFED GROUSE SOCIETY

For information on the management of forest habitats for ruffed grouse and other wildlife species, contact **The Ruffed Grouse Society, 451 McCormick Road, Coraopolis, PA, 15108, Phone: 412-564-6747, www.ruffedgrousesociety.org**

VERNAL POOLS: NATURAL HISTORY AND CONSERVATION

Vernal Pools: Natural History and Conservation. Colburn, Elizabeth, 2004. This book provides excellent background on the ecology of vernal pools in one comprehensive source. Numerous materials are also available on the web, including guidelines that have been developed and are in use by several states in the northeastern United States.

WILD TURKEY: ECOLOGY AND MANAGEMENT IN WISCONSIN

Wild Turkey: Ecology and Management in Wisconsin. Bureau of Integrated Science Services, Wisconsin DNR, Madison, Wisconsin, 2001. This publication gives a complete account of wild turkey re-introduction, management, and ecology in Wisconsin. Landowners interested in managing their land for wild turkeys should consider this source as a definitive guide to wild turkey biology in Wisconsin.

WILDFLOWERS OF WISCONSIN AND THE GREAT LAKES REGION

Wildflowers of Wisconsin and the Great Lakes Region: A Comprehensive Field Guide. Madison, Wisconsin: University of Wisconsin Press, 2009. This guide contains more than 1,100 species of flowering plants, including many rare species. County-level range maps are provided for each species. This is a great companion to the Wisconsin State Herbarium and Freckmann Herbarium web sites and is small enough to carry.

WILDLIFE AND YOUR LAND: A SERIES ABOUT MANAGING YOUR LAND FOR WILDLIFE

Wildlife and Your Land: A Series About Managing Your Land for Wildlife. Wisconsin DNR Bureau of Wildlife Management. This source served as the foundation for many wildlife issues covered in this chapter of the *Forest Management Guidelines*. This collaborative effort focuses on different management issues land managers and owners should consider when managing their property. Available in hardcopy or online at **http://dnr.wi.gov/org/land/wildlife/publ/wildland.htm**.

WISCONSIN BREEDING BIRD ATLAS WEB SITE

www.uwgb.edu/birds/wbba/

University of Wisconsin-Green Bay. This web site displays the results of the Wisconsin Breeding Bird Atlas performed from 1995 to 2000 on private and public lands across the state. It is a good source of information for the range and distribution of bird species within the state. The web site will generate a species list by quad or county, and also contains pictures of the species that could be used in identification.

WISCONSIN STATE HERBARIUM AND FRECKMANN HERBARIUM WEB SITES

www.botany.wisc.edu/herbarium/
http://wisplants.uwsp.edu/

These web sites contain online herbarium records for all plants found in Wisconsin. Search for plants by species, genus, family, common name, or many other characteristics. Each species description contains information on location, habitat, photos, and a floristic rating. The Wisconsin Herbarium site also contains links to the Atlas of the Wisconsin Prairie and Savanna Flora, the Lichens of Wisconsin, and other web resources. Rare plant locations are only given to the county level for both sites, but the Freckmann site provides township-level maps for non-rare species. For rare plants, these web sites are an excellent companion to the Bureau of Endangered Resources web pages, **http://dnr.wi.gov/org/land/er/biodiversity/**.

WISCONSIN WILDLIFE ACTION PLAN

Wisconsin Wildlife Action Plan. Wisconsin DNR, 2006. Wisconsin's Wildlife Action Plan (WWAP) identifies the native Wisconsin animals in greatest need of conservation, along with the habitats (natural communities) and places (Ecological Landscapes) they use.

The plan is part of a nationwide effort to outline steps needed to conserve wildlife and habitat before they become rarer and more costly to protect. The plan is available online, and a variety of tools have been developed to allow users quick access to information from the plan: **http://dnr.wi.gov/org/land/er/wwap/explore/**.

WISCONSIN'S BIODIVERSITY AS A MANAGEMENT ISSUE

Wisconsin's Biodiversity as a Management Issue. Wisconsin DNR, 1995. This report was written for Wisconsin DNR managers to provide a context for their work. This report is a good general source for information on the landscape surroundings a given property providing an overview on issues and implications of Wisconsin's rich biotic heritage and an overview of the ecological, social and economic issues tied to each major community type.